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(54) **JET UNITS FOR WHIRLPOOL-BATH SYSTEMS**

DÜSENEINHEITEN FÜR WHIRLPOOL-BADEWANNENSYSTEME

UNITES DE JETS POUR SYSTEMES DE BAINS A REMOUS

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Description

[0001] This invention relates to jet units for whirlpool-bath systems, of the kind in which a housing of the unit has an internal cavity with an open mouth, a flanged hollow stem for clamping the housing to the bath provides an outlet of the unit for discharging a jet of water into the bath, said stem extending axially into the cavity through said mouth to define an air chamber within the unit between an open rear end of the stem and the inside of the housing, and in which a stream of water is discharged across a gap into the rear-end opening of the hollow stem from a nozzle such as to entrain air admitted to the chamber via an air inlet with the water stream in the gap, said gap being defined by axial spacing of the nozzle from the rear end of the stem, the rear end of the stem having a part that extends axially from it in the direction upstream of the water flow to shroud the gap, the said part shrouding the gap within the air chamber for constricting air flow from the chamber into the gap to an annular space defined between that part and a nose-part of the nozzle.

[0002] A form of jet unit of the above-specified kind is described in DE-A-3807135 in the context of the use of a number of such jet units in a whirlpool-bath system (otherwise referred to as a hydro-massage system) for injecting jets of water mixed with air into the bath. The jet units are clamped to the wall of the bath at distributed locations round the bath with the object of injecting jets of the mixed water into the bath and thereby create foaming and turbulence which has an invigorating and/or therapeutic effect on the one or more occupants of the bath.

[0003] Water is supplied under pressure to each individual jet unit from a respective water-supply pipe, and air is drawn or pumped into the unit to be entrained with the water stream discharged into the gap from the open-ended, constant-bore pipe or nozzle. The resultant water stream is discharged as a jet into the bath through the hollow-stem outlet of the jet unit, and in the bath is intended to produce turbulence and a general whirlpool effect that is intensified by the entrained air.

[0004] The extent of turbulence and desired whirlpool effect created by the jet from the outlet of the jet unit is dependent upon the degree with which the air is mixed with the water stream. With the known form of jet unit, the degree of mixing can be expected to be superficial and the results consequently poor unless a high water pressure is used and the air is pumped.

[0005] It is an object of the present invention to provide a form of jet unit of said specified kind, by which improved mixing of air with the water stream can be achieved without the need for an air pump.

[0006] According to the present invention a jet unit of the said specified kind is characterised in that the nozzle has an outlet diameter less than its inlet diameter such that the water-flow passage within the nozzle towards the gap is convergent in the direction of water flow so

as to constrict water flow into the gap for enhancing the suction of air into the gap by venturi action, and that the constriction of the annular space is such that in consequence of the enhanced suction, the air is drawn into the gap with a substantially even distribution around the gap to result in enhanced mixing of the air with the water in the jet from the outlet.

[0007] With the jet unit of the present invention the suction created by the water flow from the nozzle tends in consequence to draw air strongly into the gap from around the whole circumference of the nozzle within the chamber. The constriction precludes the possibility of all, or most, of the air aspirated entering over a limited sector, and moreover accelerates the air to enhance further the formation of small bubbles for good mixing and improved turbulence.

[0008] It has been found that jet units constructed according to the present invention, are very effective for producing the powerful jet of well-mixed water and entrained air desired for the hydro-massage or whirlpool effect. Moreover, it enables the units to be smaller than otherwise so that they can be better, and less obtrusively, accommodated around the bath.

[0009] The internal passage of the hollow outlet stem may be divergent in the same direction, from the rear-end opening. The outlet may provide simply for a fixed-direction of discharge of the jet of water and entrained air into the bath, but may include provision for adjusting or varying the direction of such discharge.

[0010] The gap-shrouding part at the rear end of the stem extends over the nose-part of the nozzle to define with the nose-part an annular pathway for air from the chamber to the gap that increases in cross-sectional area towards the gap. The pathway may alternatively be of substantially uniform cross-sectional area throughout.

[0011] The stem may screw into the housing for clamping the housing to the bath-wall with the stem through the wall, and the gap-shrouding part may be formed by a circumferential skirt which projects backwardly with respect to the stem. The skirt may be substantially cylindrical and coaxial with the rear-end opening of the stem.

[0012] The housing may have a transversely-extending tube for coupling to a water supply. The nozzle may open transversely from this tube within the housing to project into the air chamber, and the air inlet may be from a pipe that extends from the cylindrical housing in abutment with the transversely-extending tube so as to project from the housing substantially at right angles to both the housing and the tube.

[0013] A whirlpool-bath system including jet units according to the present invention, will now be described, by way of example, with reference to the accompanying drawings, in which:

Figures 1 and 2 are schematic plan and side views, respectively, of the whirlpool-bath system; and

Figures 3 and 4 are a front elevation and a sectional side-elevation, respectively, of a typical jet unit of the system, the jet unit being shown as mounted on the bath in the system of Figures 1 and 2, with the section of Figure 4 taken on the line IV-IV of Figure 3.

[0014] Referring to Figures 1 and 2, the hydro-massage or whirlpool system involves eight nozzle or jet units 1 that are mounted on the tub or bath 2 (two are mounted on each side, two at the head, and two at the foot) for injecting jets of water with entrained air, into the bath 2 below the normal water-level. Water is supplied to the jet units 1 under pressure via a pipe or line 3 that extends around and/or under the bath 2 from an electric pump 4. The pump 4 draws its water from the bath 2 via a pipe 5 that is coupled to an outlet 6 located below the normal water-level, near the foot of the bath 2.

[0015] Air is supplied to the jet units 1 from an eight-outlet manifold 7 (Figure 2) via individual tubes 8. The manifold 7 is part of an air-supply assembly or controller 9 that is mounted near the head of the bath 2 and incorporates a manually-adjustable air-valve 10. The valve 10 regulates the volume or rate of air admitted to the manifold 7 and supplied to the individual tubes 8, in accordance with the setting of a manual control 11. Air is drawn from the atmosphere into the valve 10, and thence into the manifold 7 for supply via the tubes 8, under suction that is created with the injection of water into the bath 2 through the units 1.

[0016] The construction of a typical nozzle or jet unit 1 is illustrated in Figures 3 and 4, and will now be described.

[0017] Referring to Figures 3 and 4, an outlet 12 of the unit 1 has a flanged-stem 13 that extends from the inside of the tub or bath 2, through the bath-wall 14, to screw into the unit-housing 15. This clamps the unit 1 securely (and in a water-tight manner) to the bath 2 with the flange 16 of the outlet 12 against the wall 14 on the inside, and the housing 15 held hard on the outside of the bath 2.

[0018] The housing 15 has a transversely-extending tube-section 17 and it is by means of this that the unit 1 is coupled into the water-supply line 3. A nozzle 18 opens from the tube-section 17 and projects into an air chamber 19 within the housing 15. The nozzle 18 is axially aligned with the hollow stem 13 to supply water under pressure into the outlet 12 across an air-gap 20 between the nozzle 18 and the stem 13 in the chamber 19. An air-inlet pipe 21, to which the air-tube 8 individual to the unit 1 is coupled, opens into the chamber 19 around the gap 20. Issue of water from the nozzle 18 across the gap 20 creates suction by the venturi effect, and this suction draws air into the chamber 19 from the pipe 21. The air is entrained with the water in the gap 20 to cause a foaming and turbulent jet discharge from the outlet 12.

[0019] Mixing of the air with the water in the gap 20 is enhanced by the provision of a circumferential skirt 22

that projects backwardly from the stem 13 to shroud the gap 20. The skirt 22 surrounds the gap 20 and extends over a frusto-conical nose-part 23 of the nozzle 18. This restricts admission of air to the gap 20 from the chamber 19, to the annular space 24 between the skirt 22 and nose-part 23. The shrouding of the gap 20 together with the consequent constriction of air-entry to it, serves to even out distribution of air around the stream of water from the nozzle 18.

[0020] If the shrouding were absent, the gap 20 would be open and air would be entrained mostly in that part of the water stream closest to the inlet pipe 21 within the chamber 19. This would lead to uneven distribution of air around the stream of water from the nozzle 18. As a consequence there would be superficial mixing of the air with the water, with large air-bubbles congregating together in one sector of the discharged jet and rapidly breaking away from the jet when it enters the main body of water in the bath 2. Desirably, there is an even distribution of entrained air around the water stream from the nozzle, with a large number of small bubbles mixed throughout the jet injected from the outlet 12 into the bath-water.

[0021] Even distribution of entrained air is achieved in the present case through the constriction of entry of air to the gap 20. More especially, air is constricted to enter the gap 20 through the annular space 24, so that the suction created by the water flow draws air into the gap 20 from around the whole circumference of the nozzle within the chamber 19. The constriction precludes the possibility of all, or most, of the air sucked in entering over a limited sector, and furthermore accelerates the air to enhance further the formation of small bubbles.

[0022] The convergence of the nose-part 23 towards the gap 20 is greater than the convergence of the internal surface of the skirt 22 over the nose-part 23, so the pathway for air between the nozzle 18 and the skirt 22 is of increasing cross-sectional area towards the gap 20. The internal surface of the skirt 22 might in this respect be cylindrical rather than convergent. Alternatively, it may be of the same convergent angle as the nose-part 23 to give a substantially uniform cross-sectional area throughout the pathway; in this way the cross-sectional area would remain the same irrespective of the extent to which the stem 13 is screwed into the housing 15 in clamping the unit 1 to the bath 2.

[0023] The whirlpool-system is brought into operation by switching on electric supply to the pump 4 after the bath 2 has been suitably filled with water. The pump 4 draws water from the bath 2 into the pipe 5 via the outlet 6, and transfers this under pressure to the water-supply line 3. Water supplied to the line 3 issues through the nozzle 18 within the housing 15 at each of the eight jet units 1.

[0024] At each of the jet units 1, water flow from the nozzle 18 across the associated gap 20 and into the outlet 12, draws air into the system through the valve 10 at a rate dependent upon the setting of the control 11. The

air as supplied from the manifold 7 to the chamber 19 of the individual unit 1 is accelerated into the annular space 24 and distributed substantially evenly around the water stream by the constricting circumferential skirt 24. The jet discharged through the outlet 12 to be injected into the bath 2 from the unit 1, in consequence contains a large number of small bubbles distributed substantially evenly throughout the cross-section of the jet and creates strong and optimum turbulence and whirlpool effect in the bath 2.

[0025] The whirlpool effect produced by the jet units 1 can be varied by adjusting the control 11 of the air-supply controller 9 to vary the volume or rate of air admitted to the chamber 19.

[0026] Although the system described above involves just eight jet units 1, more or fewer can readily be provided, each generating a powerful jet of well-mixed air and water to give the desired hydro-massage or whirlpool-bath effect. It has been found that because of their efficiency in this regard, as many as twenty jet units can be supplied with water from the one pump. This is especially advantageous in the provision of systems for baths or pools of larger capacity than that illustrated in Figures 1 and 2.

[0027] The construction of jet unit described makes no provision for varying the angular orientation of the issuing jet. Such provision may be made, but the simplicity of the jet unit described, with its small outlet and high efficiency, enables many more units to be accommodated in a given area than is otherwise possible, and thereby reduces much of the necessity or desirability for variable-angle jets.

[0028] Although in the whirlpool system described above, a single air-supply assembly or controller 9 is used to control air flow to all the jet units 1 of the bath, it would clearly be possible to use one or more further such assemblies to control air supply to individual groupings of the jet units, so that, for example, different jet effects could be obtained selectively in different parts of the bath. Moreover, although only one jet unit is coupled to each individual supply tube from the distribution manifold in the described systems, two or more might be supplied by each such tube.

Claims

1. A jet unit for a whirlpool-bath system in which a housing (15) of the unit has an internal cavity with an open mouth, a flanged hollow stem (13) for clamping the housing to the bath (2) provides an outlet (12) of the unit for discharging a jet of water into the bath (2), said stem (13) extending axially into the cavity through said mouth to define an air chamber (19) within the unit between an open rear end of the stem (13) and the inside of the housing (15), and in which a stream of water is discharged across a gap (20) into the rear-end opening of the

hollow stem (13) from a nozzle (18) such as to entrain air admitted to the chamber (19) via an air inlet (21) with the water stream in the gap (20), said gap (20) being defined by axial spacing of the nozzle (18) from the rear end of the stem (13), the rear end of the stem (13) having a part (22) that extends axially from it in the direction upstream of the water flow to shroud the gap (20), the said part (22) shrouding the gap (20) within the air chamber (19) for constricting air flow from the chamber (19) into the gap (20) to an annular space (24) defined between that part (22) and a nose-part (23) of the nozzle (18), characterised in that the nozzle (18) has an outlet diameter less than its inlet diameter such that the water-flow passage within the nozzle (18) towards the gap (20) is convergent in the direction of water flow so as to constrict water flow into the gap (20) for enhancing the suction of air into the gap (20) by venturi action, and that the constriction of the annular space is such that in consequence of the enhanced suction, the air is drawn into the gap (20) with a substantially even distribution around the gap (20) to result in enhanced mixing of the air with the water in the jet from the outlet (12).

2. A jet unit according to Claim 1 wherein the internal passage of the hollow stem (13) is divergent in the direction of water flow, from the rear-end opening of the stem (13).
3. A jet unit according to Claim 1 or Claim 2 wherein the stem (13) screws into the housing (15) for clamping the housing (15) to the bath-wall (14) with the stem (13) extending through the wall (14).
4. A jet unit according to any one of Claims 1 to 3 wherein the gap-shrouding part (22) of the rear end of the stem (13) extends over the nose-part (23) of the nozzle (18) to define with the nose-part (23) an annular pathway (24) for air from the chamber (19) to the gap (20) that increases in cross-sectional area towards the gap (20).
5. A jet unit according to any one of Claims 1 to 3 wherein the gap-shrouding part (22) of the rear end of the stem (13) extends over the nose-part (23) of the nozzle (18) to define with the nose-part (23) an annular pathway for air from the chamber (19) to the gap (20) that is substantially uniform in cross-sectional area throughout.
6. A jet unit according to any one of Claims 1 to 5 wherein the gap-shrouding part is a circumferential skirt (22) projecting backwardly with respect to the stem (13).
7. A jet unit according to Claim 6 wherein the skirt (22) is substantially cylindrical and coaxial with the rear-

end opening of the stem (13).

8. A jet unit according to any one of Claims 1 to 7 wherein the housing (15) has a transversely-extending tube (17) for coupling to a water supply, and wherein the nozzle (18) opens transversely from this tube (17) within the housing (15) to project into the air chamber (19).
9. A jet unit according to Claim 8 wherein the air inlet is from a pipe (21) that extends from the housing (15) in abutment with the transversely-extending tube (17) to project from the housing (15) substantially at right angles to both the housing (15) and the tube (17).

Patentansprüche

1. Düseneinheit für ein Whirlpool-Badewannensystem, wobei ein Gehäuse (15) der Einheit einen Innenhohlraum mit einer offenen Mündung aufweist, durch ein hohles Flanschanschlußteil (13) zum Festklemmen des Gehäuses an der Badewanne (2) ein Auslaß (12) der Einheit zum Abgeben eines Wasserstrahls in die Badewanne (2) gebildet wird, das Anschlußteil (13) sich durch die Mündung axial in den Hohlraum erstreckt, um zwischen einem offenen hinteren Ende des Anschlußteils (13) und dem Inneren des Gehäuses (15) eine Luftkammer (19) in der Einheit zu definieren, und wobei ein Wasserstrahl aus einer Düse (18) über einen Zwischenraum (20) in die rückwärtige Öffnung des hohlen Anschlußteils (13) derart abgegeben wird, daß der Kammer (19) über den Lufteinlaß (21) zugeführte Luft mit dem Wasserstrahl in den Zwischenraum (20) angesaugt wird, wobei der Zwischenraum (20) durch axiale Beabstandung der Düse (18) vom hinteren Ende des Anschlußteils (13) definiert wird, das hintere Ende des Anschlußteils (13) einen Abschnitt (22) aufweist, der sich axial davon stromaufwärts bezüglich der Wasserströmung erstreckt, um den Zwischenraum (20) abzuschirmen, wobei der Abschnitt (22) den Zwischenraum (20) innerhalb der Luftkammer (19) abschirmt, um den Luftstrom aus der Kammer (19) in den Zwischenraum (20) zu einem Ringraum (24) einzuschränken, der zwischen dem Abschnitt (22) und einem Ansatzabschnitt (23) der Düse (18) definiert ist, dadurch gekennzeichnet, daß die Düse (18) einen Auslaßdurchmesser aufweist, der kleiner ist als der Einlaßdurchmesser, so daß der Wasserströmungskanal innerhalb der Düse (18) zum Zwischenraum (20) hin in Richtung der Wasserströmung konvergiert, so daß die Wasserströmung in den Zwischenraum (20) eingengt wird, um das Ansaugen von Luft in den Zwischenraum (20) durch den Venturi-Effekt zu verstärken, und daß das Einengen des

Ringraums derart ausgebildet ist, daß aufgrund der verstärkten Saugwirkung die Luft in den Zwischenraum (20) mit im wesentlichen gleichmäßiger Verteilung um den Zwischenraum (20) gezogen wird, um eine verstärkte Vermischung der Luft mit dem Wasser im Strahl am Auslaß (12) zu erreichen.

2. Düseneinheit nach Anspruch 1, wobei der Innenkanal des hohlen Anschlußteils (13) in der Richtung der Wasser-Strömung von der Öffnung des hinteren Endes des Anschlußteils (13) divergent ist.
3. Düseneinheit nach Anspruch 1 oder 2, wobei das Anschlußteil (13) in das Gehäuse (15) geschraubt wird, um das Gehäuse (15) an der Badewannenwand (14) festzuklemmen, wobei sich das Anschlußteil (13) durch die Wand (14) erstreckt.
4. Düseneinheit nach einem der Ansprüche 1 bis 3, wobei der den Zwischenraum umgebende Abschnitt (22) des hinteren Endes des Anschlußteils (13) sich über den Ansatzabschnitt (23) der Düse (18) erstreckt, um zusammen mit dem Ansatzabschnitt (23) einen ringförmigen Kanal (24) für Luft von der Kammer (19) zum Zwischenraum (20) zu definieren, dessen Querschnittfläche zum Zwischenraum (20) hin zunimmt.
5. Düseneinheit nach einem der Ansprüche 1 bis 3, wobei der den Zwischenraum umgebende Abschnitt (22) des hinteren Endes des Anschlußteils (13) sich über den Ansatzabschnitt (23) der Düse (18) erstreckt, um zusammen mit dem Ansatzabschnitt (23) einen ringförmigen Kanal für Luft von der Kammer (19) zum Zwischenraum (20) zu definieren, dessen Querschnittfläche im wesentlichen überall gleichmäßig ist.
6. Düseneinheit nach einem der Ansprüche 1 bis 5, wobei der den Zwischenraum umgebende Abschnitt ein Umfangsrand (22) ist, der sich bezüglich des Anschlußteils (13) nach hinten erstreckt.
7. Düseneinheit nach Anspruch 6, wobei der Rand (22) in wesentlichen zylinderförmig und koaxial zur Öffnung des hinteren Endes des Anschlußteils (13) ausgerichtet ist.
8. Düseneinheit nach einem der Ansprüche 1 bis 7, wobei das Gehäuse (15) ein sich in Querrichtung erstreckendes Rohr (17) zum Anschließen an eine Wasserzufuhr aufweist, und wobei die Düse (18) sich in Querrichtung von diesem Rohr (17) im Gehäuse (15) öffnet, so daß sie in die Luftkammer (19) hineinragt.
9. Düseneinheit nach Anspruch 8, wobei der Lufteinlaß von einem Rohr (21) ausgeht, das sich von Ge-

häuse (15) neben dem sich in Querrichtung erstreckenden Rohr (17) erstreckt, so daß es sich vom Gehäuse (15) im wesentlichen unter rechten Winkeln bezüglich sowohl des Gehäuses (15) als auch des Rohrs (17) erstreckt.

Revendications

1. Unité de jet pour un système de baignoire à remous, dans laquelle un boîtier (15) de l'unité a une cavité intérieure avec une embouchure ouverte, une tige creuse à rebord (13) pour fixer le boîtier sur la baignoire (2) constitue la sortie (12) de l'unité pour décharger un jet d'eau dans la baignoire (2), ladite tige (13) s'étendant axialement dans la cavité à travers l'embouchure pour définir une chambre à air (19) à l'intérieur de l'unité entre une extrémité arrière ouverte de la tige (13) et l'intérieur du boîtier (15), et dans laquelle un courant d'eau est déchargé en travers d'un intervalle (20) dans l'ouverture terminale arrière de la tige creuse (13) à partir d'une buse (18) de façon à entraîner de l'air, admis dans la chambre (19) par l'intermédiaire d'une arrivée d'air (21), avec le courant d'eau dans l'intervalle (20), ledit intervalle (20) étant défini par un espacement axial de la buse (18) à partir de l'extrémité arrière de la tige (13), l'extrémité arrière de la tige (13) ayant une partie (22) qui s'étend axialement à partir de celle-ci dans la direction amont de l'écoulement d'eau pour entourer l'intervalle (20), ladite partie (22) entourant l'intervalle (20) dans la chambre à air (19) pour canaliser l'air sortant de la chambre (19) dans l'intervalle (20) dans un espace annulaire (24) défini entre cette partie (22) et une partie de nez (23) de la buse (18), caractérisée en ce que la buse (18) a un diamètre de sortie inférieur à son diamètre d'entrée de sorte que le passage d'écoulement d'eau dans la buse (18) vers l'intervalle (20) soit convergent dans la direction de l'écoulement d'eau de manière à canaliser l'écoulement d'eau dans l'intervalle (20) pour renforcer l'aspiration de l'air dans l'intervalle (20) par une action de venturi, et en ce que la canalisation de l'espace annulaire est telle que, en conséquence de l'aspiration renforcée, de l'air est aspiré dans l'intervalle (20) avec une distribution pratiquement égale autour de l'intervalle (20) pour aboutir à un mélange renforcé de l'air avec l'eau dans le jet provenant de la sortie (12).
2. Unité de jet selon la revendication 1, dans laquelle le passage intérieur de la tige creuse (13) est divergent dans la direction de l'écoulement de l'eau, depuis l'ouverture terminale arrière de la tige (13).
3. Unité de jet selon la revendication 1 ou la revendication 2, dans laquelle la tige (13) se visse dans le boîtier (15) pour fixer le boîtier (15) sur la paroi (14)

de la baignoire, avec la tige (13) s'étendant à travers la paroi (14).

4. Unité de jet selon l'une des revendications 1 à 3, dans laquelle la partie (22) de l'extrémité arrière de la tige (13) entourant l'intervalle s'étend sur la partie de nez (23) de la buse (18) pour définir, en liaison avec la partie de nez (23), un passage annulaire (24) pour l'air depuis la chambre (19) vers l'intervalle (20), passage dont la surface en section transversale augmente en direction de l'intervalle (20).
5. Unité de jet selon l'une des revendications 1 à 3, dans laquelle la partie (22) de l'extrémité arrière de la tige (13) entourant l'intervalle s'étend sur la partie de nez (23) de la buse (18) pour définir, en liaison avec la partie de nez (23), un passage annulaire pour l'air depuis la chambre (19) jusqu'à l'intervalle (20), dont la surface en section transversale est pratiquement constante sur toute la longueur.
6. Unité de jet selon l'une des revendications 1 à 5, dans laquelle la partie entourant l'intervalle est une jupe circonférentielle (22) se projetant vers l'arrière par rapport à la tige (13).
7. Unité de jet selon la revendication 6, dans laquelle la jupe (22) est pratiquement cylindrique et coaxiale à l'ouverture terminale arrière de la tige (13).
8. Unité de jet selon l'une des revendications 1 à 7, dans laquelle le boîtier (15) a un tube s'étendant transversalement (17) pour raccordement à une arrivée d'eau, et dans laquelle la buse (18) s'ouvre transversalement depuis ce tube (17) à l'intérieur du boîtier (15) pour se projeter dans la chambre à air (19).
9. Unité de jet selon la revendication 8, dans laquelle l'air arrive par un tuyau (21) qui s'étend du boîtier (15) en butée avec le tube s'étendant transversalement (17) pour se projeter du boîtier (15) pratiquement à angle droit à la fois par rapport au boîtier (15) et au tube (17).

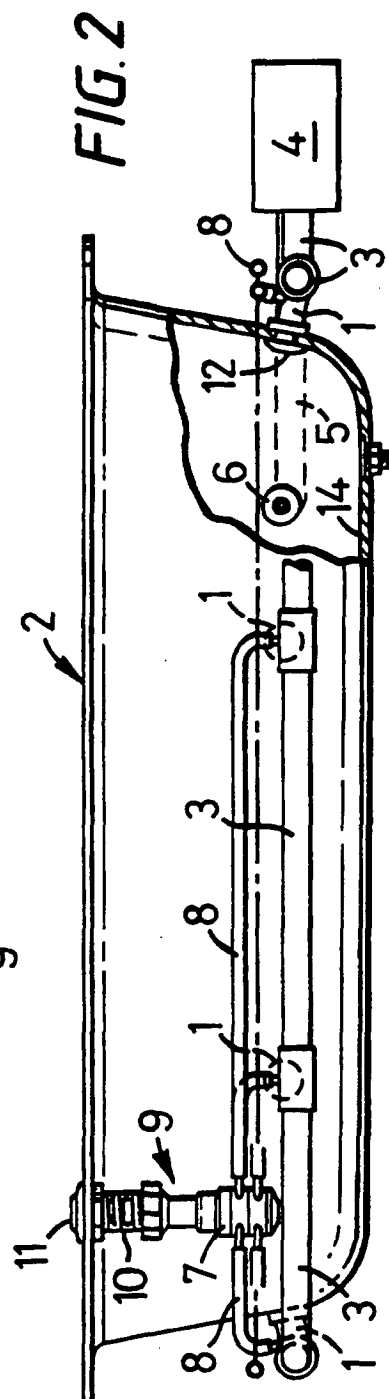
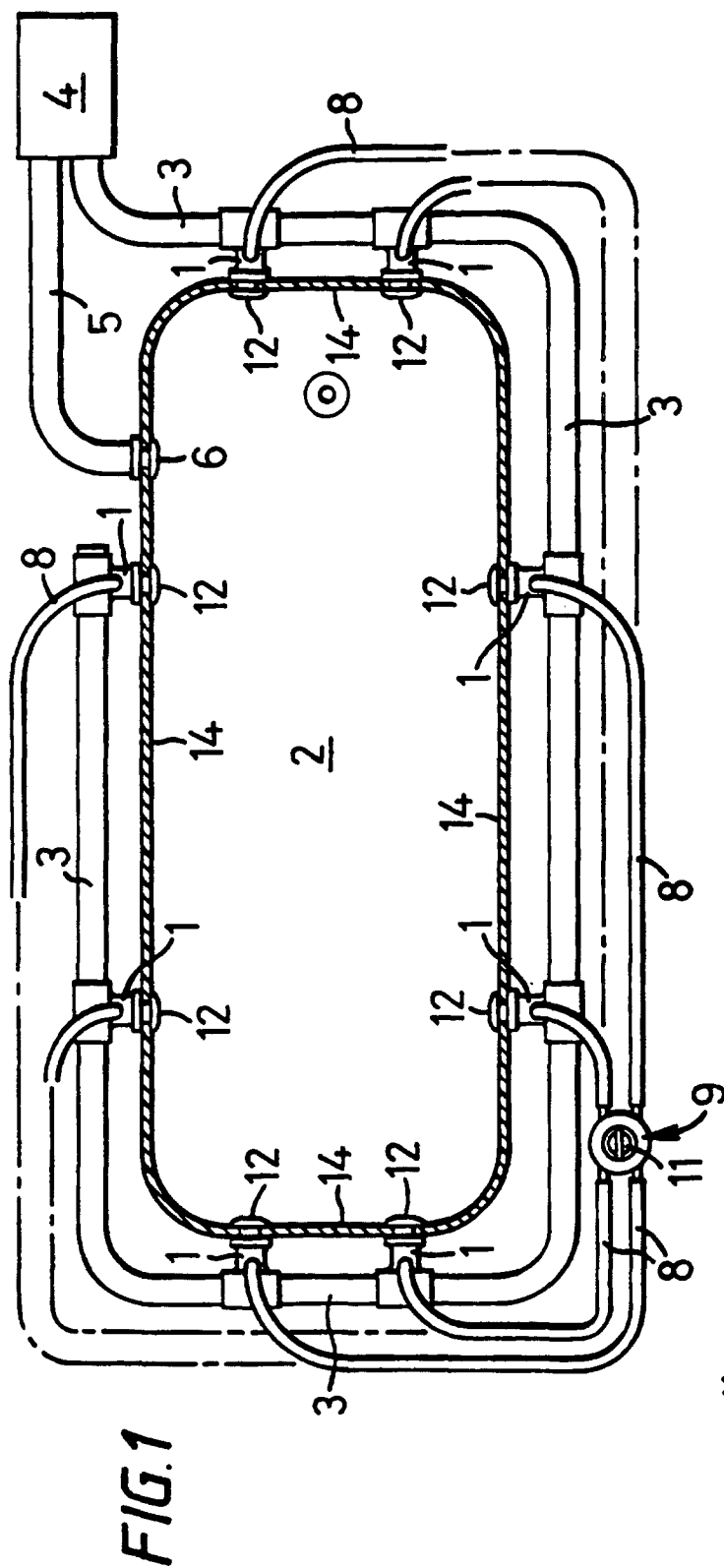


FIG. 3

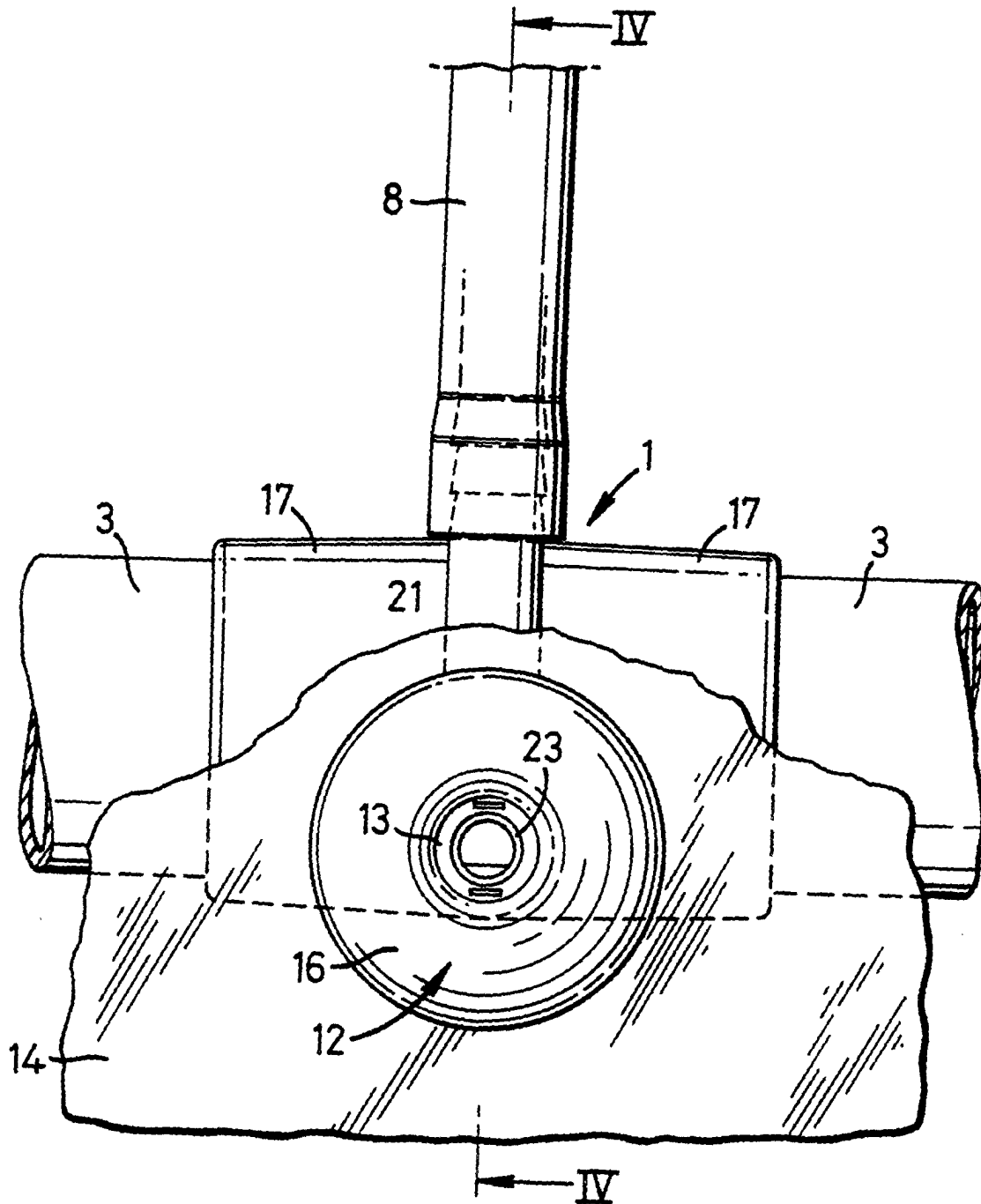


FIG. 4

